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An unknown hotspot of plant diversity in the heart of the Central Apennine: flora and vegetation outline of Mt. Pozzoni-St. Rufo valley (Cittareale, Rieti)

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Abstract

Surprisingly enough, Italy still has some botanically unexplored areas; among these there are some territories between Lazio, Umbria and Abruzzo not included in any protected area. The study area, ranging for 340 ha, includes the mountainous area of Mt. Pozzoni-Mt. Prato-St. Rufo valley, which forms the upper part of the river Velino basin, located in the territory of the municipality of Cittareale (Rieti, Lazio), at an elevation from 1150 to 1903 m a.s.l. The substrate is mainly made of marly limestone of the Meso-Cenozoic Umbria-Marche sedimentary succession. The climate is Temperate and comprises vegetation belts from the montane to sub-alpine. Land cover is dominated by pastures and deciduous forests, with only a few hay meadows. 794 entities have been detected: 16% are considered rare or very rare for the regional territory with several floristic novelties for the regional flora, 6% of the total was found to be endemic to Italy and only eight *taxa* were aliens. Four *taxa* are new for the regional flora of Lazio: *Arum cylindraceum*, *Alopecurus pratensis* subsp. *pratensis*, *Hieracium bupleuroides* and *Trinia glauca* subsp. *glauca*. Forest vegetation is represented by beech forests, while dry grasslands are the most widespread vegetation type. The greatest phytocoenotic diversity was found within the secondary pastures. Particularly interesting is the plant community with *Iris marsica*, which suggests that limestone mountain ledges can represent a primary habitat for this endemic species of the Central Apennine. The presence of several habitats listed

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in the EU Habitat Directive indicates how the lack of detailed territorial knowledge can lead to the non-designation of conservation sites in areas of high naturalistic value. These findings showed that botanical explorations in territories which are still not known could contribute significantly to the identification of areas of high interest in conserving plant diversity.

Keywords
endemic species, floristic records, Italy, phytosociology, Red lists

Introduction

The study of Central Apennine attracted the attention of several botanists in the past (e.g. Gravina 1812; Tenore 1830; Paolucci 1891; Crugnola 1900; Grande 1904; Zodda 1931, 1954; Anzalone 1951; Montelucci 1952, 1953) for the presence of the highest peaks of the Italian peninsula and of a rich flora, characterized by the presence of numerous endemics (Conti 2004). The floristic knowledge of this territory has since been progressively increased by numerous contributions (e.g. Conti 1998, 2004; Ballelli 2003; Tondi et al. 2003; Di Pietro et al. 2008; Iocchi et al. 2010; Gubellini et al. 2014; Falcinelli et al. 2016; Conti et al. 2018; Rosati et al. 2020) and some synopses have recently involved the National Parks of the Central Apennine (Conti and Bartolucci 2015, 2016; Conti et al. 2019). On a regional scale, the state of floristic knowledge of this territory has been synthesized in the recent checklist of Italian vascular flora by Conti et al. (2005) and Bartolucci et al. (2018) whilst, for Lazio, a detailed flora was published by Anzalone et al. (2010). Despite this, as already highlighted in previous publications (Scoppola and Blasi 2005; Bartolucci et al. 2012, 2019), floristic exploration of several areas of the Central Apennine cannot be considered exhaustive and homogeneous throughout the territory; consequently, particularly interesting species, of high phytogeographic interest, are still being discovered (e.g. Cancellieri et al. 2017; Filibeck et al. 2020)

As for interior areas of the Central Apennine, the attention of botanists has always been directed towards the main mountain ranges (e.g. Terminillo, Sibillini, Laga), thus large portions of the surrounding territory have been neglected, both by floristic and vegetational studies. This is the case with the area constituting the upland drainage basin of Velino River, located between Lazio, Umbria and Abruzzo administrative regions where only wet meadows were studied (Venanzoni 1992). Some studies on a national scale had already highlighted that this area lacked specific floristic knowledge; in particular the Map of the Important Plant Areas in Italy (Blasi et al. 2009, 2011) indicated how this part of the Central Apennine is surrounded by areas of high interest for plant conservation, suggesting that covering such a gap of knowledge (Hortal et al. 2015) could lead to interesting results for its flora and vegetation.

In this study we present the results of the flora and vegetation surveys conducted by the authors during the period 2008–2010 in the mountainous area of Mt. Pozzoni-Mt. Prato-St. Rufo valley, which represents the upland drainage basin of the Velino River.

Data and methods

Study area

The study area is included within the municipality of Cittareale (province of Rieti), belonging to the Lazio administrative region. It extends for 343 ha, at altitudes ranging between 1150 and 1903 m a.s.l. (Fig. 1). The study area includes the peak of Mt. Pozzoni (1903 m), extends to southeast including the mountain ridge of Mt. Laghetto-Mt. Prato (1834 m), ending in the south almost in correspondence of the provincial road Cittareale-Norcia. To the west the limit runs along the watershed that delimits the valley of St. Rufo-Pozzoni (Fig. 1).

The substrate is mainly made up of Meso-Cenozoic marly limestone ("Scaglia" formation) belonging to the Umbria-Marche succession; these sedimentary layers are heavily fractured and faulted, due to the proximity of a regional overthrust overlapping the Sibillini unit on the Gran Sasso-Cittareale unit (Calamita et al. 1995). The head of the valley is modeled by an evident glacial cirque, with a threshold placed at an altitude of 1660 m; the valley bottom is largely covered with slope debris, mixed with sediments of fluvio-glacial origin partly terraced and dissected by the upper course of Velino River. Along St. Rufo valley, an important karst cavity, 3 km long and over 400 m deep, opens at about 1440 m set in the marly limestones of Scaglia rossa formation (Gatti and Uffreduzzi 1989); the cavity has returned interesting fossil remains of bats, testifying to a cold period fauna dated to the end of the Pleistocene (Argenti et al. 2008).

Following the bioclimatic classification of Rivas-Martínez et al. (2011), the climate is Temperate oceanic/semi-continental, with the presence of two phytoclimatic belts along the altitudinal gradient, from the lower supratemperate to the lower orotemperate of the cacuminal areas; ombrotypes are comprised between humid and hyperhumid (Pesaresi et al. 2017).

The land cover is dominated by secondary grasslands, deciduous woodlands and small patches of artificial coniferous forest. Meadows and fallows are very limited and arable lands are nowadays completely missing in the study area. In the past they must have been quite common in the lower part of the valley, as evidenced by the presence of several still visible terraced parcels. Forests are used regularly as coppices and summer grazing of cattle and sheep is still widespread in this sector, together with horse grazing, which is conversely continuously present almost all year round.

The study area does not comprise any protected area, even if some Natura 2000 sites, defined according to European Union Habitat Directive (European Union 1992), are present in the neighboring territory of the Umbria region.

Flora and vegetation survey

The flora of the studied area was investigated in depth by carrying out numerous herborizations and field excursions, both in spring, summer and autumn, during three consecutive years from 2008 to 2010. Identification of vascular plants was mostly based

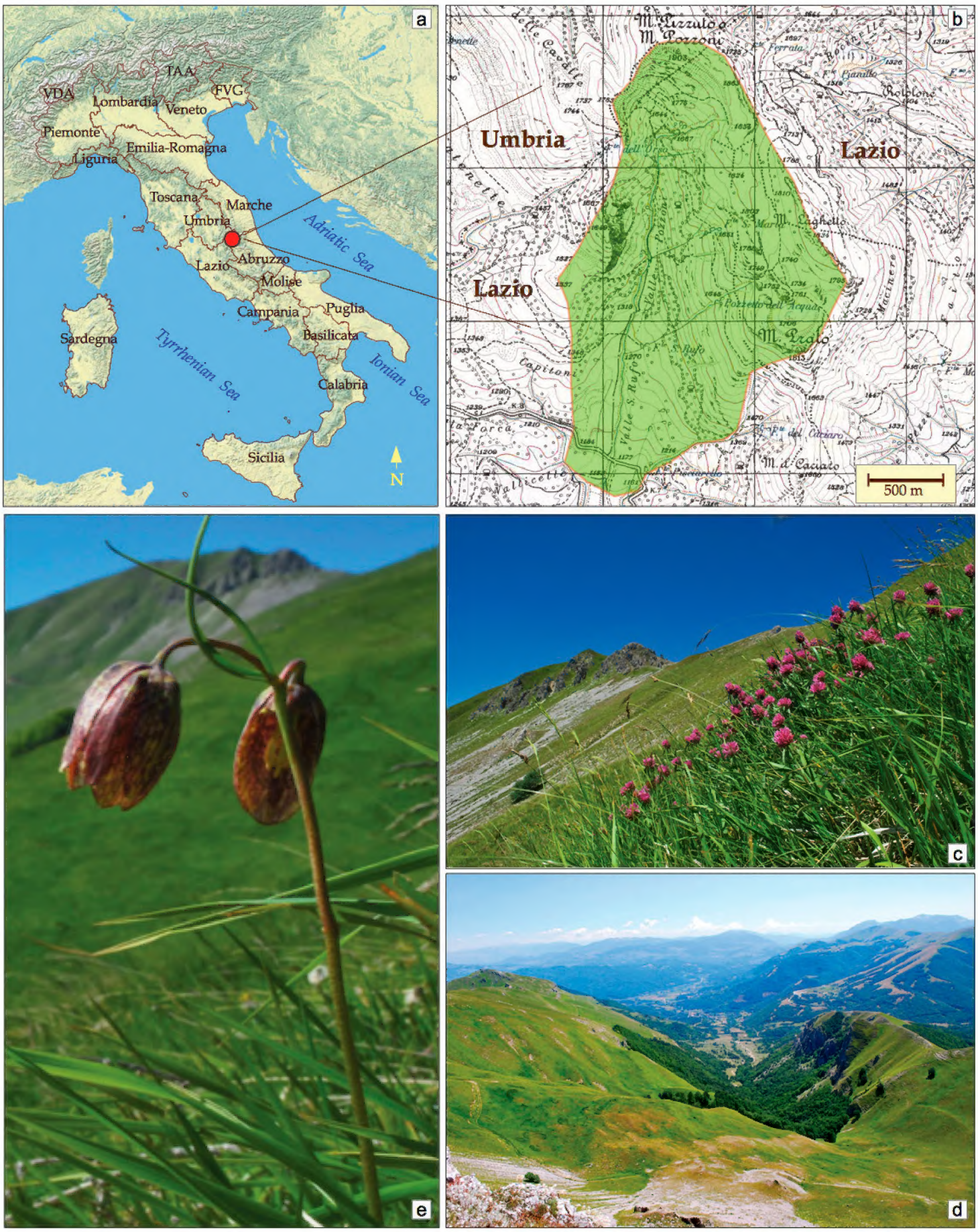

Figure 1. Study area location (**a**) and its landscape (**c–e**) **b** the limits of study area drawn on I.G.M.I-1:25,000 topographic map **c** high mountain pastures of Mt. Pozzoni dominated by *Brachypodium genuense* (DC.) Roem. et Schult. with *Trifolium alpestre* L. **e** *Fritillaria montana* Hoppe ex W.D.J.Koch, a rare species considered "Near Threatened" for extinction risk. Photos: R. Tranquilli and E. Del Vico.

on Pignatti (1982) and Flora Europaea (Tutin et al. 1968, 1972, 1976, 1980, 1993). *Taxa* delimitation was based on Anzalone et al. (2010) and nomenclature accords to Bartolucci et al. (2018), Galasso et al. (2018) and the subsequent updates summarized

in the "Portal to the Flora of Italy" (http://dryades.units.it/floritaly/). Families of vascular plants correspond to APG IV (2016), whereas life forms and chorotypes were retrieved from Pignatti (1982). Exsiccata are preserved in *Herbarium Lucanum* (HLUC), *Herbarium Del Vico* (Roma) and *Herbarium Lattanzi* (Roma), the latter is now moving to *Herbarium Sapienza* (RO). In the floristic list we reported the rarity level in the regional flora of Lazio for each *taxon* according to Anzalone et al. (2010), adopting three levels: rare, medium rare and very rare (coded as R, MR, RR). New *taxa* for the regional flora were marked with an asterisk. Italian endemics were retrieved from Bartolucci et al. (2018). As for alien *taxa*, we also reported the status of naturalization in the study area following the same codes used by Galasso et al. (2018). For each *taxon* the status of threatened species was derived by the published Italian Red lists (Conti et al. 1992, 1997) and updated, when new assessments were available, according to the most recent ones (Rossi et al. 2013; Orsenigo et al. 2020). Vegetation was analyzed using the phytosociological method (Braun-Blanquet 1965) by carrying out 30 surveys of the main vegetation types in the territory located in the field with a GPS unit with ± 5 m accuracy. The syntaxonomic nomenclature, at the level of alliance, order and class, follows the 'Prodrome of the Italian Vegetation' (Biondi et al. 2014).

Main vegetation types were identified through multivariate methods, Hierarchical Cluster Analysis and NMDS ordination. For each vegetation type a floristic-ecological description and the syntaxonomic framework were provided.

Results

Flora

794 *taxa* of vascular plants were identified, belonging to 331 genera and 69 families (Appendix 1). The families with more than 40 *taxa* (Fig. 2a) were: Asteraceae (107), Poaceae (71), Fabaceae (67), Caryophyllaceae (46) and Rosaceae (42). The most diverse genera were *Trifolium* (19), *Carex* (16), *Ranunculus* (14), *Hieracium* (13) and *Silene* (12) (Fig. 2b). Hemicryptophytes were the dominant life form (52%), followed by therophytes (21%) and geophytes (13%) (Fig. 2c). As for chorology, (Fig. 2d) species with Eurasian-Paleotemperate distribution prevailed (39%), slightly exceeding the Mediterranean element (29%). The Mediterranean group was mainly composed of Eurimediterranean (15%) and Mediterranean-Mountain species (6%). A significant contingent of Circumboreal species was also present (6%) while only a few species displayed eastern chorotypes (e.g. SE-European and Pontic).

Forty-seven *taxa*, approximately 6% of the total, were found to be endemic to Italy (Table 1). Only eight *taxa* were found to be aliens, among these *Malus domestica* (Suckow) Borkh., *Matricaria discoidea* DC., *Medicago sativa* L. and *Veronica persica* Poir. can be considered naturalized, whereas *Abies alba* Mill., *Abies cephalonica* Loudon, *Picea abies* (L.) H. Karst. and *Pinus nigra* J.F. Arnold subsp. *nigra* have been observed only as planted in reforested areas.

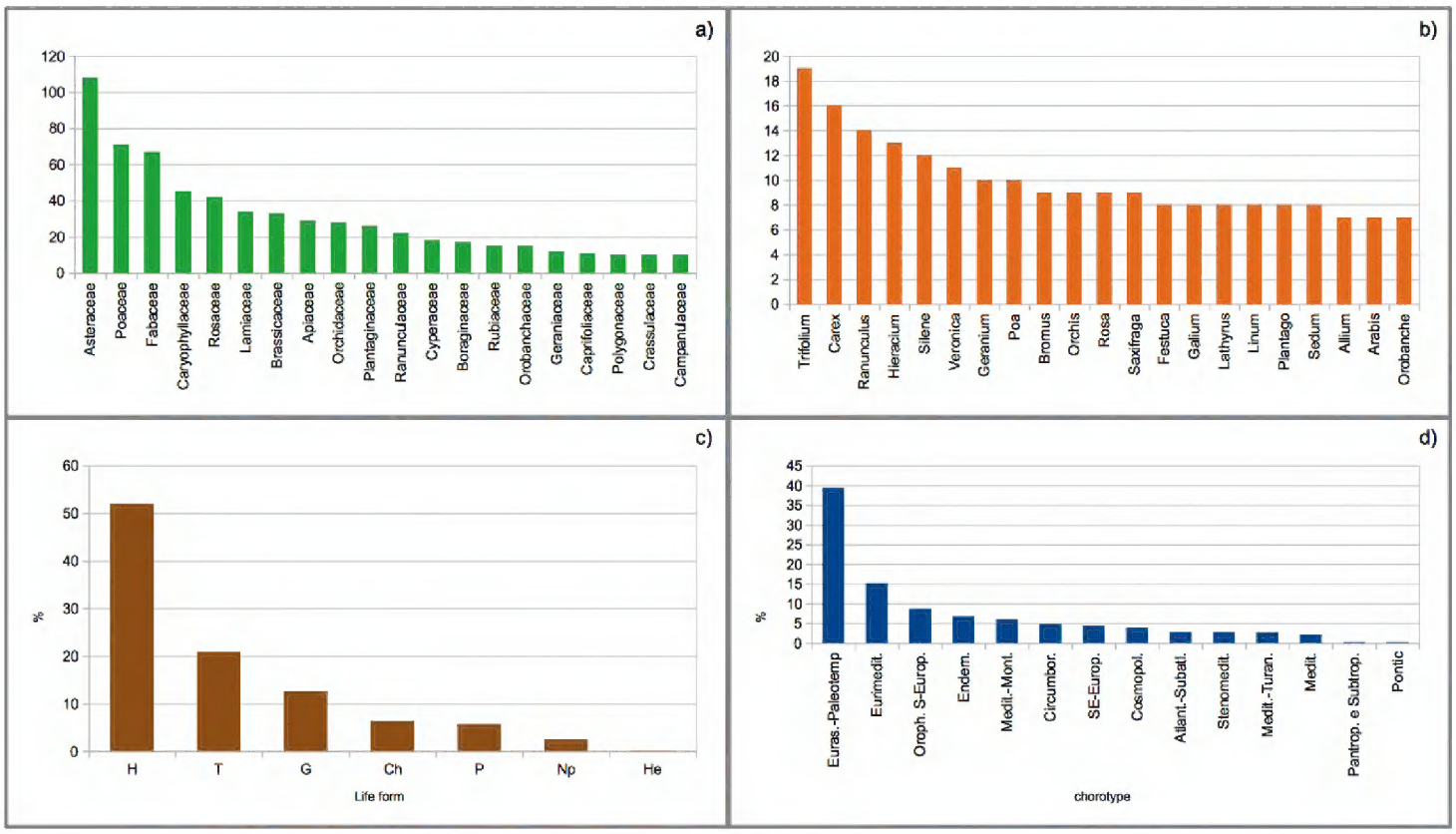

Figure 2. a number of *taxa* per family; only the families with more than 10 *taxa* are shown **b** number of *taxa* per genus; genera containing more than 7 *taxa* are shown **c** life form percentages **d** chorological spectrum of the detected flora in the study area.

Two taxa, *Arum cylindraceum* Gasp. and *Corydalis densiflora* C.Presl subsp. *apennina* F.Conti, Bartolucci & Uzunov have been recorded for the first time for Lazio during this research, whereas four *taxa* whose presence was considered doubtful for Lazio have been confirmed (*Alopecurus pratensis* L. subsp. *pratensis*, *Hieracium bupleuroides* C.C.Gmel., *Scandix macrorhyncha* C.A.Mey and *Trisetaria flavescens* (L.) Baumg. subsp. *flavescens*). These floristic records at regional level have been anticipated by Del Vico et al. (2014). However, probably due to oversight, *Alopecurus pratensis* subsp. *pratensis* is still considered to be confirmed for Lazio in the continuously updated database of the Portal to the Flora of Italy (Available at http:/dryades.units.it/floritaly, accessed: 16/11/2020). Additionally, we herein confirm the presence of *Trinia glauca* (L.) Dumort. subsp. *glauca*, previously considered recorded erroneously for Lazio (Bartolucci et al. 2018).

Thirty-four *taxa* (Table 2) are considered very rare at the regional level (2010). Considering all the rare species (R, MR and RR), these *taxa* represent altogether approximately 20% of the studied flora.

The following 15 species have been identified as being at risk of extinction in the first published Italian red lists (Conti et al. 1992, 1997): *Iris marsica* I. Ricci et Colas., *Achillea tomentosa* L., *Carex panicea* L., *Fritillaria montana* Hoppe ex Koch, *Gentiana lutea* L. subsp. *lutea*, *Gentiana utriculosa* L., *Klasea nudicaulis* (L.) Fourr., *Lathyrus nissolia* L., *Lilium bulbiferum* L. subsp. *croceum* (Chaix) Jan, *Narcissus poëticus* L., *Onobrychis arenaria* (Kit.) DC. subsp. *arenaria*, *Ornithogalum comosum* L., *Scorzonera purpurea* L., *Trifolium phleoides* Willd. and *Trisetaria villosa* (Bertol.) Banfi et Soldano.

Table 1. List of endemic *taxa* recorded in the study area.

Taxon
Armeria canescens (Host) Ebel
Astragalus sirinicus Ten.
Betonica alopecuros L. subsp. *divulsa* (Ten.) Bartolucci & Peruzzi
Brachypodium genuense (DC.) Roem. et Schult.
Campanula tanfanii Podlech
Carduus nutans L. subsp. *perspinosus* (Fiori) Arènes
Centaurea ambigua Guss. subsp. *ambigua*
Centaurea ambigua Guss. subsp. *nigra* (Fiori) Pignatti
Cerastium tomentosum L.
Corydalis densiflora C.Presl subsp. *apennina* F.Conti, Bartolucci & Uzunov
Crepis lacera Ten.
Cynoglossum apenninus L.
Cynoglossum magellense Ten.
Digitalis micrantha Roth ex Schweigg.
Epipactis meridionalis H. Baumann et R. Lorenz
Erysimum majellense Polatschek
Erysimum pseudorhaeticum Polatschek
Galium magellense Ten.
Gentianella columnae (Ten.) Holub
Helictochloa praetutiana (Parl. ex Arcang.) Bartolucci, F.Conti, Peruzzi & Banfi subsp. *praetutiana*
Iris marsica I. Ricci et Colas.
Klasea flavescens (L.) Holub subsp. *cichoracea* (L.) Greuter et Wagenitz
Koeleria splendens C. Presl
Linaria purpurea (L.) Mill.
Myosotis decumbens Host subsp. *florentina* Grau
Myosotis graui Selvi
Ornithogalum etruscum Parl.
Oxytropis pilosa (L.) DC. subsp. *caputoi* (Moraldo et La Valva) Brilli-Catt., Di Massimo et Gubellini
Pedicularis elegans Ten.
Potentilla rigoana Th.Wolf
Pulmonaria vallarsae A.Kern. subsp. *apennina* (Cristof. & Puppi) L.Cecchi & Selvi
Ranunculus apenninus (Chiov.) Pignatti
Ranunculus thomasii Ten.
Rhinanthus wettsteinii (Sterneck) Soó
Saxifraga exarata Vill. subsp. *ampullacea* (Ten.) D.A.Webb
Saxifraga porophylla Bertol. subsp. *porophylla*
Sempervivum riccii Iberite et Anzal.
Senecio apenninus Tausch
Sesleria nitida Ten
Silene notarisii Ces.
Siler montanum Crantz subsp. *siculum* (Spreng.) Iamonico, Bartolucci & F.Conti
Stipa dasyvaginata Martinovský subsp. *apenninicola* Martinovský et Moraldo
Trifolium pratense L. subsp. *semipurpureum* (Strobl) Pignatti
Trisetaria villosa (Bertol.) Banfi et Soldano
Viola eugeniae Parl. subsp. *eugeniae*

Meanwhile, in the most recent ones (Rossi et al. 2013; Orsenigo et al. 2020), excluding the species classified as "Least Concern", *Viola kitaibeliana* Schult. was listed as "Endangered", *Epipactis meridionalis* H. Baumann et R. Lorenz as "Vulnerable" and *Fritillaria montana*, *Gentiana lutea*, *Iris marsica* and *Senecio scopolii* Hoppe et Hornsch. ex Bluff et Fingerh. as "Near Threatened".

Table 2. List of *taxa* found in the study area considered very rare (RR) at regional level including those that are new records for Lazio with respect to Anzalone et al. (2010).

Taxon
Achillea tomentosa L.
Alchemilla cinerea Buser
Arabis auriculata Lam.
Arum cylindraceum Gasp.
Avenella flexuosa (L.) Drejer subsp. *flexuosa*
Carex liparocarpos Gaudin subsp. *liparocarpos*
Carex panicea L.
Centaurea arachnoidea subsp. *adonidifolia* (Rchb.) F. Conti, Moraldo & Ricceri
Conringia austriaca (Jacq.) Sweet
Corydalis densiflora C.Presl subsp. *apennina* F.Conti, Bartolucci & Uzunov
Epipactis meridionalis H. Baumann et R. Lorenz
Erysimum majellense Polatschek
Gagea minima (L.) Ker Gawl.
Genista sagittalis L.
Herniaria glabra L. subsp. *nebrodensis* Nyman
Hieracium tomentosum L.
Hypericum hyssopifolium Chaix
Iris marsica I. Ricci et Colas.
Juncus striatus Schousb. ex E. Mey.
Mcneillia graminifolia (Ard.) Dillenb. & Kadereit subsp. *clandestina* (Port.) Dillenb. & Kadereit
Medicago prostrata Jacq. subsp. *prostrata*
Onobrychis arenaria (Kit.) DC. subsp. *arenaria*
Oxytropis pilosa (L.) DC. subsp. *caputoi* (Moraldo et La Valva) Brilli-Catt., Di Massimo et Gubellini
Parnassia palustris L. subsp. *palustris*
Pilosella cymosa (L.) F.W.Schultz & Sch.Bip.
Pilosella hoppeana (Schult.) F.W.Schultz & Sch.Bip.
Pilosella piloselloides (Vill.) Soják subsp. *praealta* (Vill. ex Gochnat) S.Bräut. & Greuter
Scorzonera laciniata L.
Scorzonera purpurea L. subsp. *purpurea*
Thymus oenipontanus Heinr.Braun ex Borbás
Trifolium phleoides Willd.
Trinia glauca (L.) Dumort. subsp. *glauca*
Trisetaria villosa (Bertol.) Banfi et Soldano
Tulipa pumila Moench

Plant community descriptions

Hierarchical cluster analysis and NMDS ordination (the latter not shown) enabled the detection of 10 clusters that were clearly interpretable, floristically and ecologically, as shown in Fig. 3. A further inspection of the ordered table led to the identification of 12 plant communities (some of these represented by only one relevè); the greatest phytocoenotic diversity was found within the secondary pastures. The relevès of these communities are presented in Suppl. material 1: Table S1 and described in detail below.

Forests and shrublands

Forest vegetation in the Mt. Pozzoni valley is represented almost exclusively by beech forests (cluster 1). *Quercus cerris* woodlands are present only on the edges of the investigated area on southern exposures, but they are widespread at lower altitudes where flyschoid substrates emerge. Small patches of coniferous plantation, planted for reforestation pur-

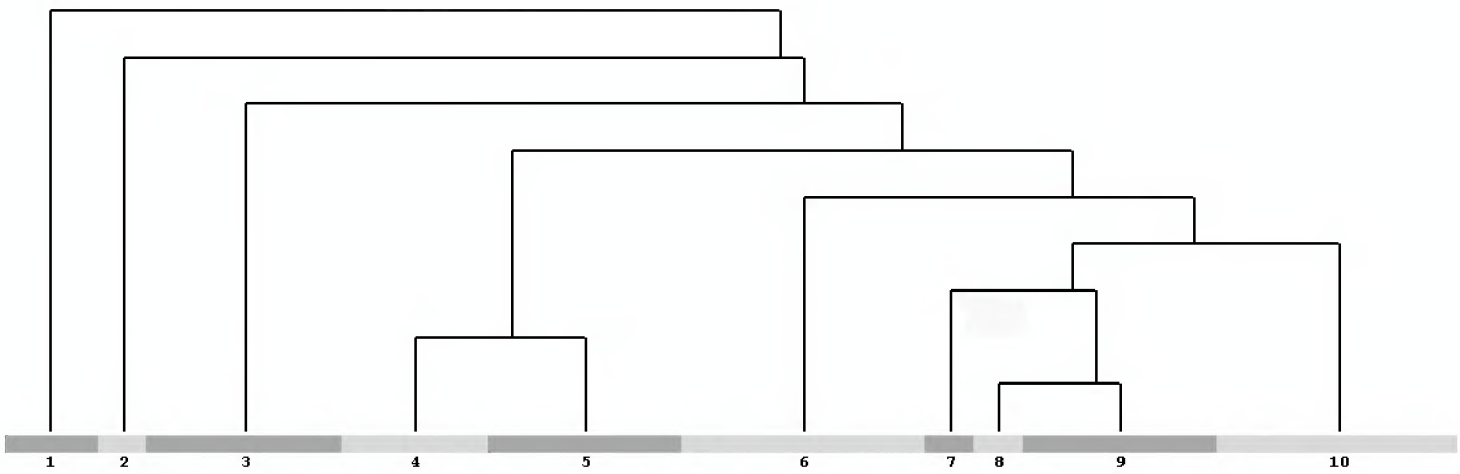

Figure 3. Hierarchical clustering resulting from Modified TWINSPAN analysis. Cluster 1) *Fagus sylvatica* woodlands; 2) *Amelanchier ovalis* forest edges; 3) *Saxifraga callosa* chasmophytic vegetation; 4) *Cynosurus cristatus* hay meadows; 5) *Bromopsis erecta* montane grasslands; 6) *Iris marsica* community; 7) *Rumex scutatus* screes vegetation; 8) *Paronychia kapela* rocky outcrops vegetation; 9) upper-montane grasslands, including also the *Brachypodium genuense* community and the *Astragalus sempervirens* community; 10) chamaephytes-rich dry grasslands.

poses (e.g. *Pinus nigra*, *Abies spp.*) are also present. *Fagus sylvatica* forests cover approx. 60 ha, forming a more or less continuous belt between 1350 and 1700 m a.s.l.; they are managed as coppices with stands, meanwhile mixed aged and old-growth formations are absent. Tree layer is always dominated by *Fagus sylvatica*, frequently accompanied by *Acer pseudoplatanus* and *Acer opalus* subsp. *obtusatum*. In relevè no. 1, surveyed at 1500 m, in the tree layer we also found *Tilia plathyphyllos* and *Prunus avium*, while in rel. no. 2, placed at 1360 m, the presence of *Quercus cerris* and *Acer campestre* can be noted. In the herb layer, nemoral species commonly found in mesic and beech forests are present, such as *Cardamine bulbifera*, *Pulmonaria vallarsae* subsp. *apennina*, *Moehringia trinervia*, *Rabelera holostea* (= *Stellaria holostea*); from a phytosociological point of view most of these species are typical of *Fagetalia sylvaticae* order. Related to the altitude, the second relevè in table S1 hosts a larger contingent of species having a relatively thermophilic character, such as *Lathyrus venetus*, *Cyclamen hederifolium*, *Cephalanthera damasonium*, *Sesleria autumnalis*, *Viola odorata*, which also characterize the lower altitudinal vegetation belt dominated by oak forests. These relevès can be classified in the alliance *Aremonio agrimonioidis-Fagion sylvaticae* (*Querco roboris-Fagetea sylvaticae*, *Fagetalia sylvaticae*) describing the beech forests of E-Europe, Balkans and extending to Central-Northern Apennine (Biondi et al. 2014). The beech woods at lower altitudes, as evidenced by the relevè no. 2, show a floristic composition referable to *Lathyro veneti-Fagetum sylvaticae*, a widespread association which frames beech forests of lower supratemperate belt of the Central Apennines mainly on limestones (Blasi et al. 2010). At higher altitudes, generally above 1500 m, it is possible to observe a clear decrease in the number of species of *Quecetalia pubescenti-petraeae*, indicating a shift towards the association *Cardamino kitaibelii-Fagetum sylvaticae* Ubaldi ex Ubaldi 1995. The latter represents the potential vegetation of the upper supratemperate belt, which in the St. Rufo valley is almost completely substituted by the secondary grasslands belonging to *Festuco-Brometea* class.

The edge of the beech forest (cluster 2), in some cases, presents characteristic preforest shrub formations, as evidenced by relevè no. 3, physiognomically dominated by

Amelanchier ovalis, *Atadinus fallax* (=*Rhamnus alpina* subsp. *fallax*) and *Sorbus aria*, accompanied by smaller shrubs of *Rosa montana*, *Crataegus laevigata* and *Cytisophyllum sessilifolium*. These formations can be attributed to the association *Rhamno alpinae-Amelanchieretum ovalis* (*Berberidion vulgaris*, *Prunetalia spinosae*, *Rhamno-Prunetea*), described for Sibillini mountains by Pedrotti (1994) and revised by Cutini et al. (2002), even if the herb layer appeared strongly impoverished.

Along the river incisions, especially in the middle and lower part of the investigated area, there are other shrub and pre-forest formations of difficult syntaxonomic classification at association level, dominated by *Corylus avellana* and *Acer spp.*, which are not represented in our surveys.

Sparse vegetation of outcrops

Limestone rocky walls, from 1400 m up to the highest peak of Mt. Pozzoni, are colonized by a characteristic chasmophytic vegetation dominated by *Saxifraga callosa* (rel. 4–6) with the presence of *Saxifraga paniculata*, *Campanula tanfanii* and *Saxifraga exarata* subsp. *ampullacea* (cluster 3). Even if *Trisetum villosum* was not found within the relevès, this species is present in such habitats of the study area (see floristic list). The overall floristic composition of these coenoses allows us to refer them to *Saxifrago australis-Trisetetum bertolonii* (*Saxifragion lingulatae*, *Potentilletalia caulescentis*, *Asplenietea trichomanis*), a widespread association in the Umbria-Marche Apennine and Central Italy (Giancola and Stanisci 2002).

On sub-vertical calcareous rocky outcrops, large boulders and ledges, we found some peculiar communities characterized by the abundance and dominance of *Sedum album*. At higher altitudes, above 1650 m (rel. no. 7–9) these coenoses are characterized by *Paronychia kapela*, *Anthemis cretica* subsp. *columnae*, *Sempervivum arachnoideum* and *Poa molinerii* (cluster 8). The floristic composition is dominated by species belonging to *Sedo albi-Scleranthetea biennis* such as *Sedum album*, *Sempervivum arachnoideum* and *Petrosedum rupestre* together with several transgressive species from dry grasslands of *Festuco-Brometea*. These coenoses developed on a calcareous substrate have to be attributed to the alliance *Alysso alyssoidis-Sedion albi*. At the alliance level, the same attribution is valid for the relevès no.10–12 (cluster 6), carried out on large rocky ledges at lower altitudes (ca 1500 m) which are physiognomically characterized by the endemic *Iris marsica* and by *Petrosedum rupestre*, with the presence of several thermophilous species such as *Crupina vulgaris*, *Lactuca perennis* subsp. *perennis* and *Centaurea deusta*. The survey no. 13, characterized also by the presence of *Iris marsica* but with the dominance of *Bromopsis erecta*, represents the ecotone between the vegetation of the *Alysso-Sedion* on ledges and the contiguous dry grasslands of *Festuco-Brometea*, which are developed where the soils are more evolved and deeper. Our current state of knowledge about *Alysso-Sedion* vegetation in the studied area does not make it possible to find a clear reference to any already described association; therefore these two coenoses are provisionally indicated as *Sedum album-Paronychia kapela* community and *Sedum album-Iris marsica* community.

Calcareous screes and mobile debris have only small surfaces in the study area; they are represented by the relevè no. 14 (cluster 7), carried out at medium altitude (1480 m), on the scree fed by the characteristic rocky spike present on the right side of the St. Rufo valley, known as Peschio dell'Aquila. This plant community has sparse cover and is characterized by *Rumex scutatus*, *Galium magellense* and *Scrophularia canina.* The scree vegetation of the alpine and subalpine belt in the Central Apennine is quite well known, while at lower altitudes it has rarely been investigated (see Ciaschetti et al. 2020 and references therein). Also in this case, it was not possible to identify a reference at the association level for the *Petrosedum rupestre-Rumex scutatus* community of the study area. The presence of *Galium magellense* suggests a probable framework within the alliance *Linario-Festucion dimorphae*, describing Apennine glareicolous communities of calcareous screes, from the supratemperate to orotemperate thermotypes, even if most of the diagnostic species are lacking. The floristic impoverishment could be justified by the fact that in the study area the most important screes are located at rather low altitudes, at the lower ecological limit of *Linario-Festucion dimorphae.* In fact, at higher altitude we observed in this habitat also the presence of *Drypis spinosa.* Although the abundance of *Petrosedum rupestre* would seem to indicate an affinity with the association *Linario purpureae-Petrosedetum rupestris* recently described for several localities of the Abruzzo territory (Ciaschetti et al. 2020), the overall floristic composition of the community herein reported is rather different from the one described for Abruzzo and the diagnostic species are absent. In addition, this thermophilic association was referred to a different order and alliance (*Scrophulario bicoloris-Helicrhysetalia italici* Brullo, 1984, *Linarion purpureae* Brullo, 1984) within the class *Thlaspietea rotundifolii.*

Meadows and grasslands

In the lower part of the study area, at an altitude below 1200 m, small patches of regularly mowed grasslands are still present (cluster 4; rel. no. 15–17), developed on deep, partially terraced, well drained alluvial soil. They are species rich, with 54 species per plot on average. Floristically, the dominant species (*Trifolium incarnatum*, *T. repens*, *T. pratense*, *Poa trivialis*, *Dactylis glomerata*, *Phleum nodosum*, *Cynosurus cristatus*) are indicators of the class *Molinio-Arrhenatheretea*, accompanied by several nitrophilous and ruderal species such as *Bromus hordeaceus* and *Dasypyrum villosum.* The perennial meso and supratemperate Apennine grasslands, usually grazed and mowed once a year, which develop on mesotrophic soils with good water availability and rich in nutrients, have been commonly attributed to the *Cynosurion cristati* alliance, (see the Italian review of the alliance in Blasi et al. 2012 and references therein). The classification of *Cynosurion* grasslands has often been considered to be somewhat problematic (Blasi et al. 2012) due to the fact that exclusive species are lacking and most of the diagnostic species range widely from both a geographical and ecological point of view. Although the surveys carried out in the study area can be referred to *Cerastio arvensis-Cynosurenion cristati* suballiance, the attribution to an already described association remains unresolved, also be-

cause the Apennine's associations have not yet been the subject of a critical review which clarifies delimitation and differential species. Probably the closest association could be identified in the *Colchico lusitani-Cynosuretum*, repeatedly reported on the Umbria-Marche Apennines (e.g. Allegrezza 2003; Biondi et al. 2004; Catorci et al. 2007).

The most widespread vegetation in the study area is represented by the dry grasslands of the *Festuco-Brometea* class (cluster 5; rel. no. 18–30), mainly used for horse and cattle grazing, which replaced the beech forest vegetation on the mountain slopes. In particular, they can be classified in *Phleo ambigui-Brometalia* order including xerophilous and semi-mesophilous secondary grasslands of the Central-southern Apennines, that occur from the supramediterranean to the upper supratemperate thermotype. These plant communities have a high physiognomic and floristic diversification in relation to local characteristics of the site (exposure, rockiness, soil depth and pH) and to the degree of grazing. The relevès no. 18–22 (cluster 10) are particularly species rich (mean 52 species per releve) and were found at lower altitude (max 1300 m), frequently on moraine deposits. They are characterized by a high incidence of chamaephytes (e.g. *Helianthemum apenninum*, *H. oelandicum* subsp. *incanum*, *H. nummularium* subsp. *obscurum*, *Thymus longicaulis*, *T. oenipontanus*) and by the presence of several therophytes (e.g. *Trifolium campestre*, *T. scabrum*, *Euphrasia liburnica*). However, they are physiognomically dominated by hemicryptophytes such as *Bromopsis erecta*, *Festuca circummediterranea*, *Phleum hirsutum* subsp. *ambiguum*. From a phytosociological point of view, the ecology and floristic analysis led to the inclusion of this community in the association *Asperulo purpureae-Brometum erecti*, frequently reported for the Umbria-Marche Apennine (e.g. Catorci et al. 2007) and described with several variants and subassociations. The releve no. 23 represents a particular stand on strongly inclined slopes at higher altitude (1500 m) dominated by *Bromopsis erecta* but with a high cover of *Securigera varia* and *Petrosedum rupestre*, which cannot be easily classified at the level of association.

At higher altitude (cluster 9) and on more inclined slopes, in the dry grasslands can be noted the presence of *Sesleria nitida* and a floristic composition close to the association *Seslerio nitidae-Brometum erecti*. Near the summit area of the mountain slopes or in eroding areas, the floristic composition becomes impoverished and the spiny chamaephyte *Astragalus sempervirens* was found as co-dominant with *Sesleria nitida*. The reference for this community is the *Astragalo sempervirenti-Seslerietum nitidae*, an association described for the grasslands of the summit sectors of Coscerno and Civitella Mountains in Umbria (Biondi and Ballelli 1995). The parts at higher altitudes of the mountain slopes, relying on calcareous-marly substrata, are occupied by grasslands dominated by *Brachypodium genuense*. The presence of some acidophilic species (e.g. *Luzula campestris*, *Genista sagittalis*, *Campanula micrantha*) which are frequently found in the vegetation of *Nardetea strictae* (see Di Pietro et al. 2017 for a review of these communities in the Italian Peninsula), indicates the presence of decarbonated soils with a lower pH. Despite this, the floristic composition is clearly dominated by *Festuco-Brometea* species; therefore, the reference for these coenoses, is the order *Phleo ambigui-Brometalia erecti* and the alliance *Phleo-Bromion erecti*, but unlike the previous ones, in this case the arid high-montane grasslands are to be referred to the sub-alliance *Brachypodienion genuensis*. At the association level, the floristic analysis led to refer-

ring this community to the *Potentillo rigoanae-Brachypodietum genuensis*, an association quite widespread in the Central Apennine, in particular in Lazio and Abruzzo regions (Lucchese et al. 1995).

We did not survey other relevant coenoses that are present with significant extensions but only outside the surveyed area: the mountain acidophilic grasslands of the *Nardetea strictae* class, present on the northern slopes of Mt. Pozzoni and in the concave morphologies in the high-mountain orotemperate belt and the discontinuous prairies of the steep slopes dominated by *Sesleria juncifolia*; the latter can be observed on the steep and inaccessible mountain slope surrounding the cliff of Peschio dell'Aquila.

Discussions and conclusions

The floristic composition of the study area, at the family level, does not significantly differ from the neighboring regional floras (Anzalone et al. 2010; Conti 1998). The percentage of endemics (6%) was quite similar to the flora of the nearby Terminillo massif (5.1%) studied by Montelucci (1952, 1953), slightly lower than the flora of Gran Sasso National Park (8.7%) (Conti and Bartolucci 2016), but perfectly aligned, for example, with the value of Abruzzo National Park (6.5%) (Conti and Bartolucci 2015). This difference can be due to the fact that the higher elevation of Gran Sasso National Park allows the presence of a large alpine vegetation belt, known to host several endemic *taxa*. On the contrary, in the study area, Terminillo massif and Abruzzo National Park, the alpine belt is completely absent. In fact, only considering the ipsophilous flora (above 1900 m a.s.l.), Conti (2004) calculated a rate of 13.2% of endemics for Central Apennine.

Similarly, from the chorogical point of view, no particular differences were observed with the flora of Terminillo, except for the contingent of Illirian, SE-European and Pontic species, which are slightly more represented in the flora of the Terminillo, probably because the flora of the latter also includes the lower vegetation belts of thermophilous oak forests and mixed deciduous woods, known to be characterized by the presence of numerous eastern species (Blasi et al. 2004).

Based on overall floristic results, the area of the St. Rufo Valley-Mt. Pozzoni can be considered of particular floristic interest, due to the high number of endemic and rare species detected, as recognized also by Lucchese (2018) who incorporated our preliminary data (Del Vico et al. 2014) in his recent, but not yet completed, atlas of the flora of Lazio.

The studied area is also undoubtedly characterized by a high floristic diversity if we consider that the 794 *taxa* recorded in this study have been found in an area of only 3,4 km^2. The relevance of these data can be easily understood by comparing the number of *taxa* detected in local floras that have a comparable extension. For example, considering the data reported in Pierini et al. (2009), regarding numerous floras from Tuscany, and limiting to those having extension between 2 and 8 km^2, only in the flora of Mt. Ferrato a similar number of *taxa* (800) was found, but within a study area almost double the size (6 km^2) (Biagioli et al. 2002).

Moreover, we have to keep in mind that the studied area has a modest altitude range, relatively few types of lithologies and thus, a limited number of habitats. Despite this, the vegetation analysis revealed the presence of varied and species rich plant communities, with 311 *taxa* detected in only 30 relevès. As expected, the higher number of vegetation types was found within the secondary habitats of mountain pastures and dry grasslands. Particularly interesting is the plant community with *Iris marsica* (referred to the *Alysso-Sedion* alliance), which indicates, probably for the first time, as limestone mountain ledges can represent a primary habitat for this species endemic of the Central Apennine.

Almost all the plant communities identified here are referable to habitats listed by the Habitat Directive (habitat codes: 6110, 6210, 6520, 8120, 8210, 9210), some of them with priority status (6110, 6210, 9210), thus their presence would have required the proposal of a Natura 2000 site according to the Habitat Directive (European Union 1992).

The intriguing aspects of this territory combined with, until recently, the complete lack of detailed botanical knowledge, led, in 2016, the Italian Botanical Society to carry out, in the Cittareale municipality, an annual field trip of the working group for Floristics, Systematics and Evolution. During the field trip, with the participation of some of the authors, several other additional localities (e.g. Mt. Boragine 1824 m a.s.l.), surrounding those herein investigated, were explored floristically (Bartolucci et al. 2019).

The very limited number of alien species identified, none of which is considered invasive, can be considered an indicator of the fairly good state of conservation of the territory in which a completely traditional land use still persists. However, reforested areas, planted with several non- native conifers, are now composed of mature trees able to produce seeds. Recruitment from these could involve a process of spontaneization of non-native coniferous as frequently observed in other territories of Central Apennine, involving, for example, the spread of *Pinus nigra*. Moreover, the presence of *Abies cephalonica* and *Picea abies* in reforested areas could also lead to spontaneization of these species in Lazio, as already observed in the neighboring Abruzzo region (Galasso et al. 2018).

Taking into account how important updating distribution data is, for example for the Red List assessment (Orsenigo et al. 2020), it is certainly possible to affirm that this study constitutes a valid contribution towards filling the gap in our botanical knowledge of a sector of the Central Apennines of high conservation interest.

Syntaxonomic scheme

ASPLENIETEA TRICHOMANIS (Br.-Bl. in Meier & Br.-Bl., 1934) Oberdorfer, 1977

POTENTILLETALIA CAULESCENTIS Br.-Bl. in Br.-Bl. & Jenny, 1926

Saxifragion australis Biondi & Ballelli ex Brullo 1984

Saxifrago-Trisetetum villosi Biondi & Ballelli, 1982

THLASPIETEA ROTUNDIFOLII Br.-Bl., 1948
THLASPIETALIA STYLOSI Avena & Bruno, 1975
Linarion purpureae Brullo, 1984
Petrosedum rupestre-Rumex scutatus community

SEDO ALBI-SCLERANTHETEA BIENNIS Br.-Bl,. 1955
ALYSSO ALYSSOIDIS-SEDETALIA ALBI Moravec, 1967
Alysso alyssoidis-Sedion albi Oberdorfer & Müller in Müller 1961
Sedum album-Paronychia kapela community
Sedum album-Iris marsica community

FESTUCO VALESIACAE-BROMETEA ERECTI Br.-Bl. & Tüxen ex Br.-Bl. 1949
PHLEO AMBIGUI-BROMETALIA ERECTI Biondi, Allegrezza, Blasi & Galdenzi in Biondi, Allegrezza, Casavecchia, Galdenzi, Gasparri, Pesaresi, Vagge and Blasi 2014
Phleo ambigui-Bromion erecti Biondi, Ballelli, Allegrezza & Zuccarello ex Biondi and Galdenzi 2012
Phleo ambigui-Bromenion erecti Biondi, Allegrezza & Zuccarello ex Di Pietro 2011
Asperulo purpureae-Brometum erecti Biondi & Ballelli ex Di Pietro 2011
Seslerio nitidae-Brometum erecti Bruno & Covarelli, 1968
Astragalo sempervirentis-Seslerietum nitidae Biondi & Ballelli, 1995
Brachypodienion genuensis Biondi, Ballelli, Allegrezza & Zuccarello ex Biondi and Galdenzi 2012
Potentillo rigoanae-Brachypodietum genuensis Lucchese et al., 1995

MOLINIO-ARRHENATHERETEA Tüxen, 1937
TRIFOLIO REPENTIS-PHLEETALIA PRATENSIS Passarge, 1969
Cynosurion cristati Tüxen, 1947
Cerastio arvensis-Cynosurenion cristati Blasi et al., 2012
Trifolium incarnatum-Cynosurus cristatus community

RHAMNO CATHARTICAE-PRUNETEA SPINOSAE Rivas Goday & Borja ex Tüxen 1962
PRUNETALIA SPINOSAE Tüxen, 1952
Berberidion vulgaris Br.-Bl., 1950
Rhamno alpinae-Amelanchieretum ovalis Pedrotti, 1994

QUERCO ROBORIS-FAGETEA SYLVATICAE Br.-Bl. & Vlieger in Vlieger 1937
FAGETALIA SYLVATICAE Pawłowski in Pawłowski, Sokołowski and Wallisch 1928
Aremonio agrimonioidis-Fagion sylvaticae (Horvat) Borhidi in Török, Podani and Borhidi 1989
Lathyro veneti-Fagetum sylvaticae Biondi et al. ex Biondi, Casavecchia, Pinzi, Allegrezza and Baldoni in Biondi, Allegrezza, Casavecchia, Galdenzi, Gigante and Pesaresi 2013

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Appendix I

Floristic list of detected *taxa* in the study area. E = endemic *taxon* of Italian territory; R, MR, RR = increasing level of rarity, form rare to very rare in the regional flora of Lazio coded as in Anzalone et al. (2010). Floristic novelties for the regional flora are marked with asterisk. CULT = *taxon* detected only as cultivated. NAT = alien *taxon* naturalized in the study area.

	Taxon
	Ferns and ferns allies
	Selaginellaceae
	Selaginella denticulata (L.) Spring
	Equisetaceae
	Equisetum palustre L.
	Equisetum ramosissimum Desf.
	Equisetum telmateja Ehrh.
	Ophioglossaceae
R	*Botrychium lunaria* (L.) Sw.
	Cystopteridaceae
	Cystopteris fragilis (L.) Bernh.
	Aspleniaceae
	Asplenium ceterach L. subsp. *bivalens* (D.E.Mey.) Greuter & Burdet
	Asplenium onopteris L.
	Asplenium ruta-muraria L. subsp. *ruta-muraria*
	Asplenium trichomanes L. subsp. *quadrivalens* D.E. Mey.
	Gymnosperms
	Pinaceae
CULT	*Abies alba* Mill.
CULT	*Abies cephalonica* Loudon
CULT	*Picea abies* (L.) H. Karst.
CULT	*Pinus nigra* J.F. Arnold subsp. *nigra*
	Cupressaceae
	Juniperus communis L. subsp. *alpina* (Suter) Celak
	– *taxon* delimitation according to Anzalone et al. (2010)
	Juniperus communis L. subsp. *communis*
	– *taxon* delimitation according to Anzalone et al. (2010)
	Juniperus oxycedrus L. subsp. *oxycedrus*
	– *taxon* delimitation according to Anzalone et al. (2010)
	Angiosperms
	Araceae
*RR	*Arum cylindraceum* Gasp. ex Guss.
	Arum italicum Mill. subsp. *italicum* var. *italicum*
	Arum maculatum L.
	Colchicaceae
	Colchicum lusitanum Brot.
	Liliaceae
R	*Fritillaria montana* Hoppe ex W.D.J.Koch
	Gagea lutea (L.) Ker Gawl.
RR	*Gagea minima* (L.) Ker Gawl.
	Gagea villosa (M. Bieb.) Sweet
	Lilium bulbiferum L. subsp. *croceum* (Chaix) Jan
RR	*Tulipa pumila* Moench
	Orchidaceae
	Anacamptis morio (L.) R.M.Bateman, Pridgeon & M.W.Chase
	Anacamptis pyramidalis (L.) Rich.
	Cephalanthera damasonium (Mill.) Druce
	Cephalanthera longifolia (L.) Fritsch
	Cephalanthera rubra (L.) Rich.
	Coeloglossum viride (L.) Hartm.

	Taxon
	Dactylorhiza maculata (L.) Soó subsp. *saccifera* (Brongn.) Diklić
	Dactylorhiza sambucina (L.) Soó
	Epipactis atrorubens (Hoffm.) Besser
E – RR	*Epipactis meridionalis* H. Baumann & R. Lorenz
	Epipactis microphylla (Ehrh.) Sw.
	Epipactis muelleri Godfery
	Gymnadenia conopsea (L.) R. Br.
	Himantoglossum adriaticum H. Baumann
	Neotinea tridentata (Scop.) R.M.Bateman, Pridgeon & M.W.Chase
	Neotinea ustulata (L.) R.M.Bateman, Pridgeon & M.W.Chase
	Neottia nidus-avis (L.) Rich.
	Neottia ovata (L.) Bluff & Fingerh.
	Ophrys apifera Huds.
	Ophrys holosericea (Burnm.f.) Greuter subsp. *holosericea*
	Ophrys sphegodes Mill. subsp. *sphegodes*
	Orchis anthropophora (L.) All.
	Orchis mascula (L.) L. subsp. *mascula*
MR	*Orchis pallens* L.
	Orchis pauciflora Ten.
	Orchis purpurea Huds.
	Orchis simia Lam.
	Platanthera bifolia (L.) Rich.
Iridaceae	
	Crocus vernus (L.) Hill
E – RR	*Iris marsica* I. Ricci & Colas.
Asphodelaceae	
	Asphodeline lutea (L.) Rchb.
Amaryllidaceae	
	Allium dentiferum Webb et Berthel.
R	*Allium flavum* L. subsp. *flavum*
R	*Allium horvatii* Lovrić
R	*Allium lusitanicum* Lam.
	Allium sphaerocephalon L.
	Allium tenuiflorum Ten.
	Allium vineale L.
	Galanthus nivalis L.
	Narcissus poëticus L.
Asparagaceae	
	Loncomelos brevistylus (Wolfner) Dostál
	Loncomelos pyrenaicum (L.) Hrouda ex J. Holub subsp. *pyrenaicum*
	Muscari neglectum Guss. ex Ten.
MR	*Ornithogalum comosum* L.
E	*Ornithogalum etruscum* Parl.
	Ornithogalum umbellatum L.
	Polygonatum multiflorum (L.) All.
	Scilla bifolia L
Juncaceae	
	Juncus articulatus L. subsp. *articulatus*
	Juncus bufonius L.
	Juncus inflexus L. subsp. *inflexus*
RR	*Juncus striatus* Schousb. ex E. Mey.
	Luzula campestris (L.) DC. subsp. *campestris*
	Luzula sylvatica (Huds.) Gaudin subsp. *sylvatica*
Cyperaceae	
	Carex caryophyllea Latourr.
	Carex distans L.
	Carex divulsa Stokes

		Taxon
		Carex flacca Schreb. subsp. *flacca*
		Carex halleriana Asso
		Carex hirta L.
		Carex kitaibeliana Degen ex Bech.
R		*Carex leporina* L.
RR		*Carex liparocarpos* Gaudin subsp. *liparocarpos*
		Carex macrolepis DC.
		Carex otrubae Podp.
R		*Carex pairae* F.W. Schultz
RR		*Carex panicea* L.
		Carex pendula Huds.
		Carex sylvatica Huds.
R		*Carex viridula* Michx.
		Schoenoplectus lacustris (L.) Palla
		Scirpoides holoschoenus (L.) Soják
	Poaceae	
R		*Agrostis canina* L.
		Agrostis stolonifera L.
		Aira caryophyllea L. subsp. *caryophyllea*
		Aira elegantissima Schur subsp. *elegantissima*
		Alopecurus aequalis Sobol.
*		*Alopecurus pratensis* L. subsp. *pratensis*
		Anisantha sterilis (L.) Nevski
		Anisantha tectorum (L.) Nevski
		Anthoxanthum odoratum L. subsp. *odoratum*
		Arrhenatherum elatius (L.) P. Beauv. ex J. Presl & C. Presl subsp. *elatius*
RR		*Avenella flexuosa* (L.) Drejer subsp. *flexuosa*
R		*Bellardiochloa variegata* (Lam.) Kerguélen subsp. *variegata*
E – R		*Brachypodium genuense* (DC.) Roem. et Schult.
		Brachypodium rupestre (Host) Roem. et Schult.
		Brachypodium sylvaticum (Huds.) P.Beauv. subsp. *sylvaticum*
		Briza media L.
		Bromopsis erecta (Huds.) Fourr.
		Bromopsis ramosa (Huds.) Holub subsp. *ramosa*
		Bromus commutatus Schrad.
		Bromus hordeaceus L. subsp. *hordeaceus*
R		*Bromus lanceolatus* Roth
		Bromus racemosus L. subsp. *racemosus*
		Bromus squarrosus L. subsp. *squarrosus*
		Cynodon dactylon (L.) Pers.
		Cynosurus cristatus L.
		Cynosurus echinatus L.
		Dactylis glomerata L. subsp. *glomerata*
		Dasypyrum villosum (L.) P. Candargy
		Elymus caninus (L.) L.
		Elymus repens (L.) Gould. subsp. *repens*
		Festuca circummediterranea Patzke
		Festuca heterophylla Lam.
R		*Festuca inops* De Not.
		Festuca laevigata Gaudin
		Festuca stricta Host subsp. *trachyphylla* (Hack.) Patzke ex Pils
		Glyceria notata Chevall.
E		*Helictochloa praetutiana* (Parl. ex Arcang.) Bartolucci, F.Conti, Peruzzi & Banfi subsp. *praetutiana*
		Holcus lanatus L. subsp. *lanatus*
R		*Hordelymus europaeus* (L.) Harz
		Koeleria australis A. Kern.
		Koeleria callierii (Domin) Ujhelyi

	Taxon
E	*Koeleria splendens* C. Presl
	Koeleria subcaudata (Asch. & Graebn.) Ujhelyi
	Leucopoa dimorpha (Guss.) H.Scholz & Foggi
	Lolium arundinaceum (Schreb.) Darbysh. subsp. *arundinaceum*
	Lolium multiflorum Lam.
	Lolium perenne L.
	Lolium pratense (Huds.) Darbysh.
	Melica ciliata L. subsp. *ciliata*
	Melica uniflora Retz.
	Nardus stricta L.
	Phleum alpinum L.
	Phleum nodosum L.
	Phleum hirsutum Honck. subsp. *ambiguum* (Ten.) Cif. & Giacom.
	Phleum pratense L. subsp. *pratense*
	Poa alpina L. subsp. *alpina*
	Poa annua L.
	Poa bulbosa L.
	Poa compressa L.
	Poa infirma Kunth
MR	*Poa molinerii* Balb.
	Poa nemoralis L. subsp. *nemoralis*
	Poa pratensis L. subsp. *pratensis*
	Poa sylvicola Guss.
	Poa trivialis L.
	Sesleria autumnalis (Scop.) F.W. Schultz
	Sesleria juncifolia Suffren subsp. *juncifolia*
E	*Sesleria nitida* Ten. subsp. *nitida*
E	*Stipa dasyvaginata* Martinovský subsp. *apenninicola* Martinovský et Moraldo
	Trisetaria flavescens (L.) Baumg. subsp. *flavescens*
E – RR	*Trisetaria villosa* (Bertol.) Banfi et Soldano
Ranunculaceae	
	Actaea spicata L.
	Anemone ranunculoides (L.) Holub
	Clematis vitalba L.
	Delphinium ajacis L.
	Delphinium consolida L. subsp. *consolida*
	Delphinium fissum Waldst. et Kit. subsp. *fissum*
	Eranthis hyemalis (L.) Salisb.
	Ficaria verna Huds. subsp. *verna*
	Hepatica nobilis Schreb.
R	*Ranunculus acris* L. subsp. *acris*
E – R	*Ranunculus apenninus* (Chiov.) Pignatti
MR	*Ranunculus bulbosus* L. subsp. *bulbosus*
R	*Ranunculus gramineus* L.
	Ranunculus illyricus L.
	Ranunculus lanuginosus L.
	Ranunculus millefoliatus Vahl
	Ranunculus monspeliacus L. subsp. *monspeliacus*
	Ranunculus repens L.
	Ranunculus sardous Crantz
	Ranunculus sceleratus L.
E – MR	*Ranunculus thomasii* Ten.
MR	*Ranunculus tuberosus* Lapeyr.
Papaveraceae	
	Corydalis cava (L.) Schweigg. et Körte subsp. *cava*
	Corydalis pumila (Host) Rchb.
E – RR	*Corydalis densiflora* C.Presl subsp. *apennina* F.Conti, Bartolucci & Uzunov

	Taxon
	Papaver dubium L. subsp. *dubium*
	Papaver rhoeas L. subsp. *rhoeas*
Crassulaceae	
	Petrosedum rupestre (L.) P.V.Heath
	Sedum acre L.
	Sedum album L.
R	*Sedum atratum* L. subsp. *atratum*
	Sedum dasyphyllum L.
	Sedum hispanicum L.
	Sedum rubens L.
	Sedum sexangulare L.
R	*Sempervivum arachnoideum* L.
E	*Sempervivum riccii* Iberite et Anzal.
Grossulariaceae	
R	*Ribes alpinum* L.
MR	*Ribes multiflorum* Kit. ex Roem. et Schult. subsp. *multiflorum*
R	*Ribes uva-crispa* L. subsp. *uva-crispa*
Saxifragaceae	
	Saxifraga adscendens L. subsp. *adscendens*
	Saxifraga bulbifera L.
R	*Saxifraga callosa* Sm. subsp. *callosa*
E – R	*Saxifraga exarata* Vill. subsp. *ampullacea* (Ten.) D.A.Webb
	Saxifraga granulata L. subsp. *granulata*
	Saxifraga paniculata Mill.
E	*Saxifraga porophylla* Bertol. subsp. *porophylla*
	Saxifraga rotundifolia L. subsp. *rotundifolia*
	Saxifraga tridactylites L.
Fabaceae	
	Anthyllis montana L. subsp. *jacquinii* (Rchb.f.) Rohlena
R	*Anthyllis vulneraria* L. subsp. *pulchella* (Vis.) Bornm.
	Anthyllis vulneraria L. subsp. *rubriflora* (DC.) Arcang.
	Astragalus depressus L. subsp. *depressus*
	Astragalus glycyphyllos L.
R	*Astragalus sempervirens* Lam.
E – MR	*Astragalus sirinicus* Ten.
	Colutea arborescens L.
	Coronilla minima L. subsp. *minima*
	Coronilla scorpioides (L.) W.D.J. Koch
	Cytisophyllum sessilifolium (L.) O. Lang
	Cytisus hirsutus L.
	Lotus herbaceus (Vill.) Jauzein
RR	*Genista sagittalis* L.
	Genista tinctoria L.
	Hippocrepis comosa L. subsp. *comosa*
MR	*Hippocrepis glauca* Ten.
	Lathyrus cicera L.
	Lathyrus latifolius L.
	Lathyrus nissolia L.
	Lathyrus pratensis L. subsp. *pratensis*
	Lathyrus sphaericus Retz.
	Lathyrus sylvestris L. subsp. sylvestris
	Lathyrus venetus (Mill.) Wohlf.
	Lathyrus vernus (L.) Bernh.
MR	*Lotus corniculatus* L. subsp. *alpinus* (DC.) Rothm.
	Lotus corniculatus L. subsp. *corniculatus*
	Medicago falcata L. subsp. *falcata*
	Medicago lupulina L.

		Taxon
		Medicago minima (L.) L.
RR		*Medicago prostrata* Jacq. subsp. *prostrata*
NAT		*Medicago sativa* L.
RR		*Onobrychis arenaria* (Kit.) DC. subsp. *arenaria*
		Onobrychis viciifolia Scop.
		Ononis pusilla L. subsp. *pusilla*
		Ononis reclinata L.
		Ononis spinosa L. subsp. *spinosa*
E – RR		*Oxytropis pilosa* (L.) DC. subsp. *caputoi* (Moraldo et La Valva) Brilli-Catt., Di Massimo et Gubellini
		Securigera varia (L.) Lassen
		Spartium junceum L.
		Trifolium alpestre L.
		Trifolium angustifolium L. subsp. *angustifolium*
		Trifolium arvense L.
		Trifolium campestre Schreb.
		Trifolium dubium Sibth.
		Trifolium fragiferum L. subsp. *fragiferum*
		Trifolium incarnatum L. subsp. *molinerii* (Balb. ex Hornem.) Ces.
		Trifolium micranthum Viv.
R		*Trifolium montanum* L. subsp. *rupestre* (Ten.) Nyman
		Trifolium nigrescens Viv. subsp. *nigrescens*
		Trifolium ochroleucum Huds.
		Trifolium pallidum Waldst. et Kit.
RR		*Trifolium phleoides* Willd.
		Trifolium pratense L. subsp. *pratense*
E		*Trifolium pratense* L. subsp. *semipurpureum* (Strobl) Pignatti
		Trifolium repens L.
		Trifolium scabrum L.
		Trifolium squarrosum L.
R		*Trifolium thalii* Vill.
		Trigonella gladiata M. Bieb.
		Trigonella officinalis (L.) Coulot & Rabaute
		Vicia angustifolia L.
		Vicia cracca L.
		Vicia dasycarpa Ten.
		Vicia incana Gouan
MR		*Vicia onobrychioides* L.
		Vicia sepium L.
	Polygalaceae	
R		*Polygala alpestris* Rchb. subsp. *alpestris*
		Polygala major Jacq.
MR		*Polygala nicaeensis* W.D.J. Koch subsp. *mediterranea* Chodat
	Rosaceae	
		Agrimonia eupatoria L. subsp. *eupatoria*
RR		*Alchemilla cinerea* Buser
MR		*Alchemilla glaucescens* Wallr.
R		*Alchemilla monticola* Opiz
MR		*Alchemilla strigosula* Buser
		Amelanchier ovalis Medik. subsp. *ovalis*
		Aremonia agrimonoides (L.) DC. subsp. *agrimonoides*
MR		*Cotoneaster integerrimus* Medik.
		Crataegus laevigata (Poir.) DC.
		Crataegus monogyna Jacq.
		Filipendula vulgaris Moench
		Fragaria vesca L. subsp. *Vesca*
MR		*Geum molle* Vis. et Pancic
		Geum urbanum L.
NAT		*Malus domestica* (Suckow.) Borkh.

	Taxon
	Malus sylvestris (L.) Mill.
R	*Potentilla detommasii* Ten.
	Potentilla micrantha Ramond ex DC.
R	*Potentilla pedata* Willd ex Hornem.
	Potentilla recta L.subsp. *recta*
	Potentilla reptans L.
E	*Potentilla rigoana* Th.Wolf
	Poterium sanguisorba subsp. *balearicum* (Bourg. ex Nyman) Stace
	Prunus avium (L.) L.
	Prunus mahaleb L.
	Prunus spinosa L. subsp. *spinosa*
	Pyrus communis L. subsp. *pyraster* (L.) Ehrh.
	Rosa arvensis Huds.
	Rosa balsamica Besser
	Rosa canina L. s.s.
	Rosa corymbifera Borkh.
MR	*Rosa montana* Chaix
	Rosa pouzinii Tratt.
	Rosa spinosissima L.
	Rosa squarrosa (A. Rau) Boreau
MR	*Rosa villosa* L.
	Rubus caesius L.
	Rubus canescens DC.
	Rubus hirtus Waldst. et Kit.
	Rubus idaeus L. subsp. *idaeus*
	Rubus ulmifolius Schott
	Sorbus aria (L.) Crantz
	Rhamnaceae
R	*Atadinus alpinus* (L.) Raf.
R	*Atadinus fallax* (Boiss.) Hauenschild
R	*Atadinus pumilus* (Turra) Hauenschild subsp. *pumilus*
R	*Rhamnus saxatilis* Jacq.
	Urticaceae
	Urtica dioica L. subsp. *dioica*
	Fagaceae
	Fagus sylvatica L. subsp. *sylvatica*
	Quercus cerris L.
	Quercus pubescens Willd. subsp. *pubescens*
	Betulaceae
	Corylus avellana L.
	Ostrya carpinifolia Scop.
	Cucurbitaceae
	Bryonia dioica Jacq.
	Celastraceae
	Euonymus europaeus L.
	Euonymus latifolius (L.) Mill.
RR	*Parnassia palustris* L. subsp. *palustris*
	Violaceae
	Viola alba Besser subsp. *dehnhardtii* (Ten.) W.Becker
	Viola arvensis Murray
E	*Viola eugeniae* Parl. subsp. *eugeniae*
MR	*Viola kitaibeliana* Schult.
	Viola odorata L.
	Viola reichenbachiana Jord. ex Boreau
	Salicaceae
	Populus tremula L.
	Salix apennina A.K. Skortsov
	Salix caprea L.

	Taxon
	Salix eleagnos Scop.
MR	*Salix purpurea* L. subsp. *purpurea*
Linaceae	
	Linum catharticum L. subsp. *catharticum*
	Linum corymbulosum Rchb.
	Linum strictum L.
	Linum tenuifolium L.
MR	*Linum tommasinii* (Rchb.) Nyman
	Linum trigynum L.
	Linum usitatissimum L. subsp. *angustifolium* (Huds.) Thell.
R	*Linum viscosum* L.
Hypericaceae	
RR	*Hypericum hyssopifolium* Chaix
	Hypericum perforatum L. subsp. *veronense* (Schrank) Ces.
	Hypericum tetrapterum Fr.
Euphorbiaceae	
	Euphorbia amygdaloides L.
	Euphorbia cyparissias L.
	Euphorbia falcata L. subsp. *falcata*
R	*Euphorbia myrsinites* L. subsp. *myrsinites*
Geraniaceae	
	Erodium ciconium (L.) L'Hér.
	Erodium cicutarium (L.) L'Hér. subsp. *cicutarium*
	Geranium columbinum L.
	Geranium dissectum L.
	Geranium lucidum L.
	Geranium molle L.
MR	*Geranium nodosum* L.
	Geranium purpureum Vill.
	Geranium pyrenaicum Burm. fil. subsp. *pyrenaicum*
	Geranium robertianum L.
	Geranium rotundifolium L.
	Geranium sanguineum L.
Onagraceae	
	Chamaenerion angustifolium (L.) Scop.
	Chamaenerion dodonaei (Vill.) Schur ex Fuss
	Epilobium montanum L.
	Epilobium parviflorum Schreb.
Lythraceae	
	Lythrum hyssopifolia L.
Sapindaceae	
	Acer campestre L.
	Acer opalus Mill. subsp. *obtusatum* (Waldst. & Kit. ex Willd.) Gams
	Acer pseudoplatanus L.
Thymelaeaceae	
	Daphne laureola L.
	Daphne oleoides Schreb. subsp. *oleoides*
Cistaceae	
	Helianthemum apenninum (L.) Mill. subsp. *apenninum*
MR	*Helianthemum nummularium* (L.) Mill. subsp. *grandiflorum* (Scop.) Schinz et Thell.
	Helianthemum nummularium (L.) Mill. subsp. *obscurum* (Celak.) Holub
	Helianthemum oelandicum (L.) Dum. Cours. subsp. *incanum* (Willk.) G. López
	Helianthemum salicifolium (L.) Mill.
Malvaceae	
	Malva alcea L.
	Malva sylvestris L.
	Tilia platyphyllos Scop. subsp. *platyphyllos*
Resedaceae	

	Taxon
	Reseda luteola L.
	Brassicaceae
	Aethionema saxatile (L.) R.Br.
	Alliaria petiolata (M. Bieb.) Cavara et Grande
	Alyssum alyssoides (L.) L.
	Alyssum simplex Rudolphi
	Arabidopsis thaliana (L.) Heynh.
	Arabis alpina L. subsp. *caucasica* (Willd.) Briq.
RR	*Arabis auriculata* Lam.
	Arabis collina Ten. subsp. *collina*
	Arabis hirsuta (L.) Scop.
	Arabis sagittata (Bertol.) DC.
	Barbarea bracteosa Guss.
	Barbarea vulgaris R. Br.
	Biscutella laevigata L. subsp. *laevigata* var. *laevigata*
	Bunias erucago L.
	Capsella bursa-pastoris (L.) Medik. subsp. *bursa-pastoris*
	Capsella rubella Reut.
	Cardamine bulbifera (L.) Crantz
	Cardamine impatiens L. subsp. *impatiens*
RR	*Conringia austriaca* (Jacq.) Sweet
	Draba aizoides L. subsp. *aizoides*
	Draba verna L. subsp. *verna*
E – RR	*Erysimum majellense* Polatschek – after Iocchi et al. (2010) this is the second record for Lazio, thus representing a confirmation of its presence in the region.
E	*Erysimum pseudorhaeticum* Polatschek
R	*Hesperis laciniata* All. subsp. *laciniata*
	Hesperis matronalis L. subsp. *matronalis*
	Hornungia petraea (L.) Rchb. subsp. *petraea*
	Isatis tinctoria L. subsp. *tinctoria*
	Microthlaspi perfoliatum (L.) F.K.Mey.
	Mummenhoffia alliacea (L.) Esmailbegi & Al-Shehbaz
	Pseudoturritis turrita (L.) Al-Shehbaz
	Rapistrum rugosum (L.) All.
	Sinapis arvensis L. subsp. *arvensis*
MR	*Turritis glabra* L.
	Loranthaceae
	Loranthus europaeus Jacq.
	Santalaceae
	Thesium humifusum DC.
R	*Thesium linophyllon* L.
R	*Viscum album* L.
	Plumbaginaceae
E	*Armeria canescens* (Host) Ebel
	Polygonaceae
R	*Bistorta officinalis* Delarbre
	Fallopia convolvulus (L.) A. Löve
	Polygonum arenastrum Boreau subsp. *arenastrum*
	Polygonum aviculare L. subsp. *aviculare*
	Rumex acetosa L. subsp. *acetosa*
	Rumex acetosella L. subsp. *pyrenaicus* (Pourr. ex Lapeyr.) Akeroyd
R	*Rumex alpinus* L.
R	*Rumex arifolius* All.
	Rumex crispus L.
	Rumex scutatus L. subsp. *scutatus*
	Caryophyllaceae
	Agrostemma githago L. subsp. *githago*
	Arenaria leptoclados (Rchb.) Guss. subsp. *leptoclados*

	Taxon
	Arenaria serpyllifolia L. subsp. *serpyllifolia*
	Cerastium arvense L. subsp. *arvense*
	Cerastium brachypetalum Desp. ex Pers. subsp. *brachypetalum*
	Cerastium brachypetalum Desp. ex Pers. subsp. *roeseri* (Boiss. et Heldr.) Nyman
	Cerastium brachypetalum Desp. ex Pers. subsp. *tenoreanum* (Ser.) Soó
	Cerastium ligusticum Viv.
E	*Cerastium tomentosum* L.
	Dianthus carthusianorum L. subsp. *carthusianorum*
	Dianthus deltoides L. subsp. *deltoides*
R	*Dianthus hyssopyfolius* L.
	Dianthus longicaulis Ten.
R	*Drypis spinosa* L. subsp. *spinosa*
RR	*Herniaria glabra* L. subsp. *nebrodensis* Nyman
	Herniaria hirsuta L. subsp. *hirsuta*
	Herniaria incana Lam.
RR	*Mcneillia graminifolia* (Ard.) Dillenb. & Kadereit subsp. *clandestina* (Port.) Dillenb. & Kadereit
	Moehringia trinervia (L.) Clairv.
	Paronychia kapela (Hacq.) A. Kern. subsp. *kapela*
	Petrorhagia dubia (Raf.) G. López et Romo
	Petrorhagia prolifera (L.) P. W. Ball. et Heywood
	Petrorhagia saxifraga (L.) Link subsp. *saxifraga*
	Rabelera holostea (L.) M.T.Sharples & E.A.Tripp
	Sabulina glaucina (Dvořáková) Dillenb. & Kadereit
	Sabulina tenuifolia (L.) Rchb. subsp. *tenuifolia*
R	*Sabulina verna* (L.) Rchb. subsp. *verna*
	Sagina alexandrae Iamonico
	Saponaria ocymoides L.
	Scleranthus annuus L.
	Scleranthus polycarpos L.
MR	*Silene ciliata* Pourr. subsp. *graefferi* (Guss.) Nyman
	Silene conica L.
	Silene dioica (L.) Clairv.
	Silene italica (L.) Pers. subsp. *italica*
	Silene latifolia Poir.
R	*Silene multicaulis* Guss. subsp. *multicaulis*
	Silene nemoralis Waldst. et Kit.
E – MR	*Silene notarisii* Ces.
MR	*Silene nutans* L. subsp. *nutans*
	Silene otites (L.) Wibel
MR	*Silene saxifraga* L.
	Silene vulgaris (Moench) Garcke subsp. *vulgaris*
	Stellaria media (L.) Vill. subsp. *media*
	Stellaria nemorun L. subsp. *montana* (Pierrat) Berher
	Stellaria pallida (Dumort.) Crép.
	Chenopodiaceae
	Blitum bonus-henricus (L.) Rchb.
	Chenopodium album L.
	Chenopodium opulifolium Schrad. ex W.D.J. Koch et Ziz
	Chenopodium vulvaria L.
	Primulaceae
	Cyclamen hederifolium Aiton subsp. *hederifolium*
	Lysimachia arvensis (L.) U.Manns & Anderb. subsp. *arvensis*
R	*Primula veris* L. subsp. *columnae* (Ten.) Maire & Petitm.
	Primula vulgaris Huds. subsp. *vulgaris*
	Ericaceae
	Monotropa hypopitys L.
	Orthilia secunda (L.) House

		Taxon
R		*Vaccinium myrtillus* L.
	Rubiaceae	
R		*Asperula aristata* L.f. subsp. *scabra* Nyman
		Asperula cynanchica L.
		Asperula purpurea (L.) Ehrend.
		Cruciata glabra (L.) C.Bauhin ex Opiz
		Cruciata laevipes Opiz
MR		*Cruciata pedemontana* (Bellardi) Ehrend.
		Galium album Mill. subsp. *album*
		Galium aparine L.
		Galium corrudifolium Vill.
		Galium lucidum All.
E – MR		*Galium magellense* Ten.
		Galium mollugo L.
		Galium odoratum (L.) Scop.
		Galium verum L. subsp. *verum*
		Sherardia arvensis L.
	Gentianaceae	
		Centaurium pulchellum (Sw.) Druce subsp. *pulchellum*
		Gentiana cruciata L. subsp. *cruciata*
		Gentiana lutea L. subsp. *lutea*
MR		*Gentiana utriculosa* L.
		Gentiana verna L. subsp. *verna*
E		*Gentianella columnae* (Ten.) Holub
	Apocynaceae	
		Vincetoxicum hirundinaria Medik. subsp. *hirundinaria*
	Boraginaceae	
		Aegonychon purpurocaeruleum (L.) Holub
		Anchusa azurea Mill.
		Buglossoides arvensis (L.) I.M. Johnst.
MR		*Buglossoides incrassata* (Guss.) I.M. Johnst. subsp. *incrassata*
E		*Cynoglossum apenninum* L.
E – R		*Cynoglossum magellense* Ten.
		Cynoglossum montanum L.
		Cynoglossum officinale L.
		Cynoglottis barrelieri (All.) Vural et Kit Tan subsp. *barrelieri*
		Echium italicum L. subsp. *italicum*
		Echium vulgare L.
R		*Myosotis alpestris* F.W.Schmidt
		Myosotis arvensis (L.) Hill subsp. *arvensis*
E		*Myosotis decumbens* Host subsp. *florentina* Grau
MR		*Myosotis graui* Selvi
		Onosma echioides (L.) L.
E		*Pulmonaria vallarsae* A.Kern. subsp. *apennina* (Cristof. & Puppi) L.Cecchi & Selvi
	Convolvulaceae	
		Convolvulus arvensis L.
		Cuscuta epithymum (L.) L. subsp. *epithymum*
		Cuscuta planiflora Ten.
	Plantaginaceae	
		Chaenorhinum minus (L.) Lange subsp. *minus*
		Digitalis ferruginea L.
E		*Digitalis micrantha* Roth ex Schweigg.
		Globularia bisnagarica L.
		Globularia meridionalis (Podp.) O.Schwarz
E		*Linaria purpurea* (L.) Mill.
		Plantago argentea Chaix
		Plantago atrata Hoppe subsp. *atrata*

		Taxon
		Plantago lanceolata L.
		Plantago lanceolata L. var. *sphaerostachya* Mert. et W.D.J. Koch
		Plantago major L. subsp. *major*
		Plantago media L. subsp. *media*
		Plantago sempervirens Crantz
		Plantago subulata L.
		Veronica anagallis-aquatica L. subsp. *anagallis-aquatica*
		Veronica arvensis L.
MR		*Veronica barrelieri* H.Schott ex Roem. & Schult. subsp. *barrelieri*
		Veronica beccabunga L. subsp. *beccabunga*
		Veronica chamaedrys L. subsp. *chamaedrys*
		Veronica cymbalaria Bodard subsp. *cymbalaria*
		Veronica hederifolia L. subsp. *hederifolia*
R		*Veronica orsiniana* Ten. subsp. *orsiniana*
NAT		*Veronica persica* Poir.
		Veronica polita Fr.
MR		*Veronica prostrata* L.
		Veronica serpyllifolia L.
	Scrophulariaceae	
		Scrophularia auriculata L. subsp. *auriculata*
		Scrophularia canina L.
R		*Scrophularia juratensis* Schleich.
		Scrophularia nodosa L.
		Scrophularia scopolii Hoppe ex Pers.
		Scrophularia vernalis L.
		Verbascum longifolium Ten.
		Verbascum mallophorum Boiss. et Heldr.
		Verbascum pulverulentum Vill.
	Lamiaceae	
		Ajuga chamaepitys (L.) Schreb. subsp. *chamaepitys*
		Ajuga reptans L.
E – MR		*Betonica alopecuros L.* subsp. *divulsa* (Ten.) Bartolucci & Peruzzi
		Clinopodium menthifolium (Host) Merino subsp. *menthifolium*
		Clinopodium vulgare L. subsp. *vulgare*
		Galeopsis angustifolia Hoffm. subsp. *angustifolia*
		Lamium bifidum Cirillo subsp. *bifidum*
		Lamium garganicum L. subsp. *laevigatum* Arcang.
		Lamium maculatum L.
		Lamium purpureum L.
		Marrubium incanum Desr.
		Melittis melissophyllum L. subsp. *melissophyllum*
		Mentha longifolia (L.) L.
MR		*Mentha microphylla* C. Koch
		Origanum vulgare L. subsp. *vulgare*
		Prunella laciniata (L.) L.
		Prunella vulgaris L. subsp. *vulgaris*
		Salvia glutinosa L.
		Salvia pratensis L.
		Salvia verbenaca L.
		Salvia virgata Jacq.
		Stachys heraclea All.
		Stachys recta L. subsp. *recta*
R		*Stachys recta* L. subsp. *subcrenata* (Vis.) Briq.
		Stachys tymphaea Hausskn.
		Teucrium chamaedrys L. subsp. *chamaedrys*
		Teucrium montanum L.
		Thymus longicaulis C.Presl subsp. *longicaulis*

	Taxon
RR	*Thymus oenipontanus* Heinr.Braun ex Borbás
R	*Thymus praecox* Opiz subsp. *polytrichus* (Borbás) Jalas
	Thymus striatus Vahl
	Ziziphora acinos (L.) Melnikov
	Ziziphora granatensis (Boiss. & Reut.) Melnikov subsp. *alpina* (L.) Bräuchler & Gutermann
Orobanchaceae	
MR	*Euphrasia liburnica* Wettst.
	Euphrasia stricta D. Wolff ex J.F. Lehm.
	Orobanche artemisiae-campestris Gaudin
	Orobanche caryophyllacea Sm.
	Orobanche gracilis Sm.
	Orobanche minor Sm.
MR	*Orobanche reticulata* Wallr. subsp. *reticulata*
R	*Orobanche teucrii* Holandre
R	*Orobanche variegata* Wallr.
	Parentucellia latifolia (L.) Caruel
	Pedicularis comosa L. subsp. *comosa*
E	*Pedicularis elegans* Ten.
MR	*Pedicularis tuberosa* L.
	Rhinanthus alectorolophus (Scop.) Pollich
	Rhinanthus minor L.
E	*Rhinanthus wettsteinii* (Sterneck) Soó
Campanulaceae	
	Campanula glomerata L. subsp. *glomerata*
E – MR	*Campanula micrantha* Bertol.
	Campanula rapunculus L.
	Campanula scheuchzeri Vill. subsp. *scheuchzeri*
E	*Campanula tanfanii* Podlech
	Campanula trachelium L. subsp. *trachelium*
	Edraianthus graminifolius (L.) A. DC. subsp. *graminifolius*
	Legousia hybrida (L.) Delarbre
	Legousia speculum-veneris (L.) Chaix subsp. *speculum-veneris*
R	*Phyteuma orbiculare* L.
Asteraceae	
	Achillea setacea Waldst. et Kit. subsp. *setacea*
RR	*Achillea tomentosa* L.
	Adenostyles alpina (L.) Bluff & Fingerh. subsp. *alpina*
	Anthemis arvensis L. subsp. *arvensis*
R	*Anthemis cretica* L. subsp. *columnae* (Ten.) Franzén
	Arctium lappa L.
	Arctium minus (Hill) Bernh.
	Bellis perennis L.
	Bellis sylvestris Cirillo
	Bombycilaena erecta (L.) Smoljan
	Carduus defloratus L. subsp. *carlinifolius* (Lam.) Ces.
	Carduus nutans L. subsp. *nutans*
E	*Carduus nutans* L. subsp. *perspinosus* (Fiori) Arènes
	Carlina acanthifolia All. subsp. *acanthifolia*
	Carlina acaulis L. subsp. *caulescens* (Lam.) Schübl. et G. Martens
	Carlina corymbosa L.
	Carlina vulgaris L. subsp. *vulgaris*
	Carthamus lanatus L. subsp. *lanatus*
E – MR	*Centaurea ambigua* Guss. subsp. *ambigua*
E	*Centaurea ambigua* Guss. subsp. *nigra* (Fiori) Pignatti
RR	*Centaurea arachnoidea* subsp. *adonidifolia* (Rchb.) F. Conti, Moraldo & Ricceri
	Centaurea deusta Ten.
	Centaurea jacea L. subsp. *gaudini* (Boiss. et Reut.) Gremli

	Taxon
R	*Centaurea scabiosa* L.
	Centaurea triumfettii All.
	Chondrilla juncea L.
	Cichorium intybus L. subsp. *intybus*
	Cirsium arvense (L.) Scop.
	Cirsium creticum (Lam.) d'Urv. subsp. *triumfetti* (Lacaita) Werner
	Cirsium eriophorum (L.) Scop.
R	*Cirsium palustre* (L.) Scop.
	Cota segetalis (Ten.) Holub
	Cota tinctoria (L.) J. Gay subsp. *australis* (R. Fern.) Oberprieler et Greuter
	Cota tinctoria (L.) J. Gay subsp. *tinctoria*
MR	*Crepis biennis* L.
	Crepis foetida L.
E	*Crepis lacera* Ten.
	Crepis neglecta L.
	Crepis vesicaria L. subsp. *vesicaria*
	Crupina vulgaris Cass.
	Doronicum columnae Ten.
	Echinops sphaerocephalus L. subsp. *sphaerocephalus*
	Erigeron acris L. subsp. *acris*
	Erigeron epiroticus (Vierh.) Halácsy
	Eupatorium cannabinum L. subsp. *cannabinum*
	Helminthotheca echioides (L.) Holub
R	*Hieracium bifidum* Kit. ex Hornem.
*	*Hieracium bupleuroides* C.C. Gmel.
RR	*Hieracium cymosum* L. subsp. *cymosum*
E – RR	*Hieracium hoppeanum* Schult.
R	*Hieracium lachenalii* C.C.Gmel.
	Hieracium murorum L.
MR	*Hieracium prenanthoides* Vill.
	Hieracium racemosum Waldst. et Kit. ex Willd.
RR	*Hieracium tomentosum* (L.) L.
MR	*Hieracium villosum* Jacq.
	Jacobaea erucifolia (L.) G.Gaertn., B.Mey. & Scherb. subsp. *erucifolia*
E – R	*Klasea flavescens* (L.) Holub subsp. *cichoracea* (L.) Greuter et Wagenitz
	Klasea nudicaulis (L.) Fourr.
	Lactuca perennis L. subsp. *perennis*
	Lactuca sativa L. subsp. *serriola* (L.) Galasso, Banfi, Bartolucci & Ardenghi
	Lactuca viminea (L.) J. Presl et C. Presl subsp. *chondrilliflora* (Boreau) St.-Lag.
	Lapsana communis L. subsp. *communis*
	Leontodon crispus Vill.
	Leontodon hispidus L.
	Leontodon rosanoi (Ten.) DC.
	Leontodon tuberosus L.
	Leucanthemum vulgare Lam. subsp. *vulgare*
NAT	*Matricaria discoidea* DC.
	Mycelis muralis (L.) Dumort. subsp. *muralis*
	Onopordum acanthium L. subsp. *acanthium*
	Onopordum illyricum L. subsp. *illyricum*
	Pentanema montanum (L.) D.Gut.Larr., Santos-Vicente, Anderb., E.Rico & M.M.Mart.Ort.
	Pentanema squarrosum (L.) D.Gut.Larr., Santos- Vicente, Anderb., E.Rico & M.M.Mart.Ort.
	Petasites hybridus (L.) P. Gaertn., B. Mey. et Scherb. subsp. *hybridus*
	Picris hieracioides L. subsp. *hieracioides*
	Pilosella officinarum Vaill.
	Pilosella piloselloides (Vill.) Soják
RR	*Pilosella piloselloides* (Vill.) Soják subsp. *praealta* (Vill. ex Gochnat) S.Bräut. & Greuter

	Taxon
	Prenanthes purpurea L.
	Pseudopodospermum hispanicum (L.) Zaika, Sukhor. & N.Kilian
	Ptilostemon strictus (Ten.) Greuter
	Pulicaria dysenterica (L.) Bernh.
	Scorzonera cana (C.A.Mey.) Griseb.
RR	*Scorzonera laciniata* L.
RR	*Scorzonera purpurea* L. subsp. *purpurea*
	Scorzoneroides cichoriacea (Ten.) Greuter
MR	*Senecio apenninus* Tausch
	Senecio scopolii Hoppe et Hornsch. ex Bluff et Fingerh.
R	*Serratula tinctoria* L. subsp. *tinctoria* var. *tinctoria*
	Solidago virgaurea L. subsp. *virgaurea*
	Sonchus asper (L.) Hill subsp. *asper*
R	*Sonchus asper* (L.) Hill subsp. *glaucescens* (Jord.) Ball
R	*Tanacetum corymbosum* (L.) Sch. Bip. var. *corymbosum*
	Tanacetum corymbosum (L.) Sch. Bip. var. *tenuifolium* (Willd.) Briq. et Cavill.
	Tanacetum parthenium (L.) Sch. Bip.
	Taraxacum fulvum gr.
	Taraxacum minimum (V.Brig.) N.Terracc.
	Taraxacum officinale Weber
R	*Tragopogon crocifolius* L.
R	*Tragopogon dubius* Scop.
	Tragopogon porrifolius L.
	Tragopogon pratensis L.
	Tragopogon samaritani Heldr. et Sartori ex Boiss.
	Tussilago farfara L.
	Xeranthemum cylindraceum Sm.
	Xeranthemum inapertum (L.) Mill.
Viburnaceae	
	Adoxa moschatellina L. subsp. *moschatellina*
	Sambucus ebulus L.
	Sambucus nigra L.
Dipsacaceae	
	Dipsacus fullonum L.
	Knautia purpurea (Vill.) Borbás
	Scabiosa columbaria L.
Caprifoliaceae	
	Lonicera alpigena L. subsp. *alpigena*
	Lonicera etrusca Santi
Valerianaceae	
	Centranthus ruber (L.) DC. subsp. *ruber*
	Valeriana officinalis L.
	Valeriana tuberosa L.
	Valerianella carinata Loisel.
	Valerianella eriocarpa Desv.
	Valerianella locusta (L.) Laterr.
Araliaceae	
	Hedera helix L. subsp. *helix*
Apiaceae	
	Aegopodium podagraria L.
	Angelica sylvestris L. subsp. *sylvestris*
	Anthriscus sylvestris (L.) Hoffm. subsp. *sylvestris*
	Bunium bulbocastanum L.
	Bupleurum baldense Turra
	Bupleurum falcatum L. subsp. *cernuum* (Ten.) Arcang.
	Chaerophyllum aureum L.

	Taxon
MR	*Chaerophyllum hirsutum* L.
	Chaerophyllum temulum L.
	Daucus carota L. subsp. *carota*
	Eryngium amethystinum L.
R	*Heracleum sibiricum* L. subsp. *sibiricum*
R	*Heracleum sibiricum* L. subsp. *ternatum* (Velen.) Briq.
	Katapsuxis silaifolia (Jacq.) Reduron, Charpin & Pimenov
	Oenanthe pimpinelloides L.
	Opopanax chironium (L.) W.D.J. Koch
	Orlaya grandiflora (L.) Hoffm.
R	*Pimpinella major* (L.) Huds.
	Pimpinella saxifraga L.
	Pimpinella tragium Vill.
	Sanicula europaea L.
	Scandix macrorhyncha C.A.Mey.
	Scandix pecten-veneris L. subsp. *pecten-veneris*
	Seseli montanum L. subsp. *montanum*
E	*Siler montanum* Crantz subsp. *siculum* (Spreng.) Iamonico, Bartolucci & F.Conti
	Tordylium maximum L.
	Torilis arvensis (Huds.) Link subsp. *arvensis*
	Trinia dalechampii (Ten.) Janch.
*RR	*Trinia glauca* (L.) Dumort. subsp. *glauca*

Supplementary material 1

Phytosociological releves surveyed in the study area and their syntaxonomical classification

Authors: Edda Lattanzi, Eva Del Vico, Roberto Tranquilli, Emmanuele Farris, Michela Marignani, Leonardo Rosati

Data type: Table

Explanation note: Table with the phytosociological releves surveyed in the study area and their syntaxonomical classification.

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